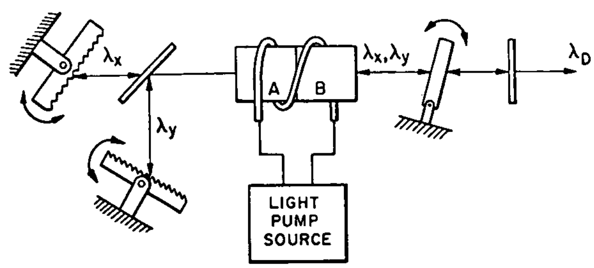
NASA TECH BRIEF

Ames Research Center

Infrared Tunable Laser—A Concept

The problem:

To provide an intense source of coherent laser radiation which is tunable from the visible through the infrared wavelengths of the electromagnetic spectrum.



The solution:

An apparatus in which the laser wavelengths of two dyes are mixed in an intracavity, nonlinear crystal.

How it's done:

As shown in the diagram, the apparatus consists essentially of a dye cell containing a solution of at least two dyes (or a cell with separate compartments, each containing a dye in solution), a pair of diffraction gratings orthogonally disposed to a selectively reflecting dichroic mirror at one end of an optical cavity, an output mirror forming the other end of the optical cavity, and a nonlinear mixing crystal.

When the dye cell is pumped by an intense light source, each dye lases over its characteristic radiation band; the dichroic mirror is selected to reflect essentially all of a narrow band of wavelengths (y) produced by one of the lasing dyes and to transmit the narrow band (x) produced by the other lasing dye. By appropriate adjustment of the angular position of each of the gratings, small bands of radiation (about 1 Å wide, within the envelopes of the bands of wavelength emitted by the lasing dyes) can be passed back through the dye cell and amplified. The amplified wavelengths are reflected back into the dye cell for further amplification because the mirror is selected so that it reflects lased light but transmits infrared radiation in the output wavelength region of interest. As the radiations in the sub-bands pass through the nonlinear mixing crystal, an additional wavelength develops which is a function of the two wavelengths selected by the diffraction gratings.

By the proper choice of mirrors, dyes, and crystals, the output wavelength is tunable from approximately 0.5 to 20 μm. The apparatus is simpler and less expensive to construct than those based on Q-switched ruby lasers. It has particular usefulness in spectroscopic studies of atoms and molecules, and further application in the detection and monitoring of certain chemical species such as may be found in polluted atmospheres.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Reference: B75-10081

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,753,148). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

NASA Patent Counsel
Mail Code 200-11A
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(continued overleaf)

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